ISSN 2654-2366

Archive

Archive Offprint

ARCHIVE

Open Access Scientific Journal

ISSN 2654-2366

Volume 14 – 2018 Offprint

Volume No: Archive Volume 14, 2018
Editor: K. Kalogeropoulos
Date: December, 16 2018

Cite as: Vernicos, N., Dascalopoulou, S. (2018). Information and the Human Use Systems, *Archive*, pp. 22-32. DOI: 10.5281/zenodo.4480800.

Information and the Human Use Systems

Λέξεις-κλειδιά: *consistency principle, global information, human use systems, information, open systems, ponape*

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Περίληψη

Η πληροφορία είναι μια μαθηματική έννοια που εισήχθη το 1949 από τον C. E. Shannon στη μαθηματική θεωρία της επικοινωνίας (Shannon and Weaver 1964). Συνδέεται με ένα ποσοτικό μέτρο εντροπίας –που θεωρείται τόσο διαταραχή όσο και μη αναστρέψιμη- και με μαρκοβιανές διεργασίες (Nicolis and Prigogine, 1989) που θα μπορούσαν να ερμηνευθούν ως αντανακλάσεις της προηγούμενης εμπειρίας. Οι πληροφορίες σε μονάδες δυαδικών ψηφίων (bits, octets κ.λπ.) είναι αυτές με τις οποίες τροφοδοτούμε τους υπολογιστές μας. Ο όρος είναι επομένως τεχνικός και είναι μια μεταφορά από την καθημερινή γλώσσα σε πιθανότητες και συνδυαστική ανάλυση. Υπάρχουν, ωστόσο, κάτι περισσότερο από απλές αναλογίες μεταξύ αυτού του είδους πληροφοριών, που υπόκεινται σε αφηρημένη λογική, και της «φυσικής πληροφορίας» (ανθρωπιστικής) που συνίσταται στην παροχή γνώσης για κάτι σε κάποιον, με νόημα, στην παροχή οδηγιών, στη μετάδοση πραγματικών δεδομένων ή απλά στην αφήγηση ή την καταγραφή. Στην πράξη, οι μαθηματικές πληροφορίες είναι ένα στοιχείο της γνώσης που κωδικοποιούμε για συντήρηση, επεξεργασία ή επικοινωνία. Η κωδικοποίηση είναι επομένως η διαδικασία που επιτρέπει τη μεταφορά «ανθρωπιστικών» πληροφοριών σε μαθηματικές εκφράσεις και το αντίστροφο. Στα συστήματα σκέψης αναφερόμαστε επίσης στις πληροφορίες ως ποιότητα που περιγράφει την «κατάσταση» ενός συστήματος. Μια «κατάσταση» από μόνη της είναι μια ιδιότητα που μπορεί να μεταδοθεί από το ένα σύστημα στο άλλο και επιτρέπει την επικοινωνία.

Information is a mathematical concept introduced in 1949 by C. E. Shannon in the mathematical theory of communication (Shannon and Weaver 1964). It is linked to a quantity measure of entropy — seen as both disorder and irreversibility — and to markovian processes (Nicolis and Prigogine, 1989) that could be interpreted as reflections of past experience. Information in binary digit units (bits, octets, etc.) is also what we feed our computers with. The term is therefore technical and is a metaphor from everyday language into probabilities and combinatorial analysis.

There are however more than mere analogies between this sort of information, subject to abstract logic, and the “mundane” (humanistic) one consisting in providing knowledge of something to someone, in making sense, in giving instructions, in transmitting factual data or simply in telling or writing down. In practice, mathematical information is an element of knowledge we code for preservation, processing or communication. Coding is therefore the procedure that allows for the transposition of “humanistic” information into mathematical expressions and vice-versa. In systems thinking we also refer to information as a quality describing the “state” of a system. A “state” is in itself a property that can be transmitted from one system to another and allows for communication.

Communication processes involve the transmission of messages with meaning. It is important to remind that the mathematical theory of communication handles the critical question of how to preserve meaning and semantics during transmission and upon decoding received messages. Information theory has thus created a technical know-how that is of great value in multilingual

and multicultural exchanges, as is the case of navigation aids and of air traffic controls. Linguistics profited from this form of quantification and from logical analysis, by developing instruments that are applied in the deconstruction of discourse for the purposes of anthropological inquiries.

Returning to our everyday "use systems", we observe that the new (abstract) languages that have been created by developing information logic, are means by which we use and control machines. Practically this tends to be the only way we have to activate machines as tools; since quasi-automates and information-geared machines are growing in number and variety. As a result, few HUS can expect to be sustainable if they do not introduce such tools. It must be added that activating machines as tools results in the production of artifacts and services. The production of services with the help of tools is an entirely new realm of human use processes and we wish to remind that the creation of artifacts and of services is eminently cultural. In other terms, it is our contention, that with similar sets of machines and with the help of the regulatory languages, different Human Use Systems have the flexibility of imparting to the products and services their own cultural meanings, as well as, several specifically culturally bound features.

We have here a process of differentiation that is supported by the sort of flexibility "information" is providing us with. Furthermore, large parts of the population — irrespective of the HUS in which they may be physically located — get acquainted with the everyday use of symbolic languages that are necessary for handling the machines. This is exactly what happened, long ago, when people learned to measure and count two actions that also require mathematical logic.

Mathematical information is also fundamental for setting, controlling and maintaining complex technical networks, among which all of us live and to which all, or most, HUS are attached. High tech networks are in themselves important components of planetary systems – of core framing techno-structures – that interact with all and every local society. There are already several concurrent global networks, and in many cases access to these networks is viewed as *a human right,* even if it clashes with the way particular HUSs functions. For this reason, we consider it useless to either underestimate their importance or overstate their cultural impact.

A very tentative listing of some of the global networks will reinforce our argument. They include: electric current grids, running water supply, sewers and refuse matter disposal, radio and television, telephone, computer 'nets', the satellite dome revolving around Earth, complete highways and railroad systems, maritime transportation, as well as the support systems of schooling, Medicare, mass transportation and also the networks used for stocking and distributing refrigerated foods.

It is remarkable that it is precisely in this high technology and largely urbanized realm that we observe a continuous emergence of minority cultures, sub-cultures and small scale communities that we evaluate to number one hundred thousand. This can be explained both by a global expansion of opportunities and by the need to decentralize the Megalopolis. It is our contention that "minorities" openly assert their existence when they secure an apparently sustainable resource base. In other words sub-cultures distinguish themselves from mainstream cultures when they can profit from the expanding opportunities and coalesce into a new Human Use System. As for decentralization it is, by definition in systems analysis, a form of learning and of internalizing information, and it recovers processes that enhance local and global stability in the context of systems theory (Rapoport 1984).

Free information and global information

At this point we wish to turn to the content of information and raise the question of the spread of inventions through contacts between human groups with clearly distinct culture and resource bases. For this we will mention Eskimo and Pacific islanders who appear to have been eager to adopt iron and glass artifacts as well as new food stuffs [4].

These two cultures have substantially long historical contacts with early modern European traders. Martin Frobisher first contacted Baffin Inuit in 1576, while attempting to discover a passage to the Pacific. Thereafter fur trade and whaling became major commercial activities between Inuit and Europeans. One should add that the Baffin Island Inuit population totaled, in 1991, 1,650 persons (*Statistics of Canada*) and we may argue with confidence that four hundred years ago their numbers were similar. Yet these communities, already facing a general climatic cooling (the Little Ice Age), were ready to establish commercial relations and adopt among other things metallic objects for hunting, pots and pans and a number of items for body adornments and dresses that are now part of their "tradition". We consider processes allowing the introduction of artifacts into a culture as typical "learning" ones.

The initial period of contacts between Europeans and Pacific Islanders roughly covers the years 1521-1680. The first date corresponds to Magellan's short stay in the Mariannas in March 1521, the second to the permanent establishment of a Spanish administration on that same island. The history is known, Guamese Chomorros began helping themselves with whatever they could seize, including a dinghy. This resulted in murderous retaliations and the islands were nicknamed "isles of the thieves" (Ladrones). A. Mendana and Pedro F. de Quiros visited the Polynesians (Marquises and Tuamotu) during two voyages, first in July 1595 and then in 1605. Thereafter, sailing towards the west, both expeditions attempted to establish Spanish colonies in Vanuatu (Scemla 1994).

What is important in the argument we present here, is not the brutality and killings that followed most of these contacts, but the readiness of the islanders to seize iron objects. Quiros even contends that the Marquesans attempted to pull out ship's nails. In 1616 the Dutch pilot of Jakob de Maire overseas expedition also noted that Takaroa's natives were well acquainted of the usefulness of iron objects and were trying to seize everything in metal they could lay hands on. This meant that between 1521 and 1616 *information* (knowledge) regarding the usefulness of iron, ways to make tools with scraps and nails, as well as a substantial body of navigation lore obtained from observing Europeans crossing the Ocean, had been largely circulated throughout the Pacific.

On the other hand, it is not very clear what was the cultural impact, if any, of the Spaniards' protracted stay in the Marquesas and in Vanuatu in terms of imported artifacts, know-how and epidemics. Obviously the islanders did not adopt corn and other introduced plants, and the first imported animals did not survive, unlike goats and wild horses in the nineteenth century. The theoretical issue is a twofold one: how, upon contact a society accepts and absorbs an innovation and, inversely, once a communication canal has been established how long it will take for external knowledge to flow along it?

The question is an actual one, since satellite TV images are broadcasted everywhere. It also a very old one: in almost all cultures traditions describe how civilizing heroes or Gods have brought the various gifts to humanity. To illustrate this point we have chosen to append an abstracted account of parts of the Micronesian "Book of Luelen" (Luelen 1977).

So far such issues have been dealt within the context of political colonialism and cultural colonialism taken as forces of acculturation or as domineering processes of change and transformation. Marxist analysts have also been concerned with the circulation of commodities (or of the 'commoditization' of all aspects of life). They examine them under the heading of alienation of things and people turned into market value categories within capitalist Human Use Systems.

It appears, however, that the "bulk transfer of knowledge" by bringing in ready made products of an entirely unknown technology may raise further problematic questions. The issue was discussed during reflections on the philosophical foundations of physics. We propose here to deal with another set of metaphors, this time taken from the philosophy of sciences. They address information, and more specifically the sort of information anthropologists are acquainted with. These metaphors consist of linking the two separate cognitive areas by placing the epistemological concepts of physics within the pattern of reasoning of Anthropology; they include the "consistency principle" and "knowledge paradoxes".

Consistency principle and knowledge paradox

The *"consistency principle"* in Physics considers that the only configurations of matter that can occur locally are those that are self-consistent globally. The potential metaphor is quite clear: we are invited to reflect as to whether we could conceive, as social scientists, of a sort of "consistence" or "self-consistency" applicable to complex societies and to complex social interactions.

If so, inputs during open system exchanges would have to undergo a screening to avoid disruption of "consistency". Symmetrically outputs could be expected to correspond to what is "consistent" to the outputting culture. From this theoretical metaphor, the possibility of reaching a global predictability for cultural behaviors, vis-à-vis outsiders, at a particular time and in specific contexts, could be investigated.

We may even go a step further, envisaging that if a "consistency" principle applies to societies and involves culture, then change and/or transformations could be moving along a path of "systemic states" that do not violate rules of self-consistency (whatever these rules may be). In other terms dynamic equilibria and "state variables" in anthropological contexts and in cultural dynamics, could be checked to assess whether they display "consistent'" configurations. A functional-structuralist approach could serve this effort, in more than one ways (Tiller 1990).

Let us now turn to *knowledge paradoxes,* as science philosophers see them. We understand that a paradox occurs if "the principle that knowledge can come into existence only as a result of problem-solving processes, such as biological evolution or human thought is violated". (Lewis 1976, Deutch & Lockwood 1994: 53)

Let us elaborate on this "paradox" with the help of an example. Bringing into metal-less societies developed metals, glass and metallic implements appears to allow knowledge to flow from outside without anyone in the recipient culture having to grapple with the corresponding problems of fabrication. Similarly if we consider "organizational" blue prints and functional norms (e.g., military ones) as artifacts created by another technology, their introduction could raise similar issues. What appear to be philosophically objectionable (at least to the philosophers of physics) "is not the knowledge-bearing artifacts. — it is the "free lunch" element. The knowledge required to invent the artifacts must not be supplied by the artifacts themselves" (Deutch and Lockwood 1994: 53-54).

Coming back to Anthropology it would appear that these sorts of problems could be dealt with within the framework of learning and cognitive processes. We know from actual observations that problem-solving processes in human use systems are not only material and actual, but also include potentialities. That is, memories, expectations and past experiences of unsolved issues and for which a 'solution is left for a later time'. In this sense metal instruments were a solution to the fragility and shortcomings of non-metallic instruments. We are also convinced that in several of the Pacific islands the 'problem-solving' processes that were left pending, and to which iron was the answer, concerned seamanship. In other terms, we suspect that for such physically isolated communities it was important to ensure subsistence and genetic health through long-range voyages. We may thus conclude by saying that when a community accepts into its HUS an input of information, artifacts or organizational models, this is an *ex post* indication that the society was already looking for them.

As for the knowledge a society may gain through forms of biological evolution, we believe that this question should be linked to issues William H. McNeal (1976) examined. They include the unification and spread of the disease pool of Eurasia, the transoceanic exchanges of epidemics and the medical care capabilities that were made available to humans after 1700. The demographic explosion of the second half of the twentieth century is also a very major biological event; it has impacted all contemporary human societies and created an irreversible effect of scale.

The two metaphors we have borrowed from the philosophy of science are open to further examination. They pose questions we could try to restate in systems thinking terminology as follows:

Does *'information within culture',* also act as a regulatory sub-system? If the answer is yes, then does it form part of larger "Emerging Human System" (i.e. a HUS)? If we further accept that societies and their resource fund coalesce into "emerging systems" (that is societal systems that encompass and transcend their systemic components), then we may further ask whether the regulator, in emerging systems, functions as a "self-regulating" dynamic system?

If so, could it be that this regulator — being an active part of culture –also functions as a bounded system that contains a minimum and a maximum amount of effective *"information"* or of *"cultural"* items? Practical ways allowing to investigate these questions will promote knowledge on the dynamic of emerging minority and sub-cultures, and partly deal with the elusive question of social systems stability.

We share a certain humanistic reluctance to approach these issues technically (Lee Downey and Rogers 1995, Carneiro 1995: 3-5) especially since we understand that some degree of mathematization will be needed to apply systems approaches. Yet quantification and classificatory logic is already on its way in Anthropology. A short (though eclectic) list will serve to illustrate what sort of mathematical treatments are currently applied to what we consider to correspond to systems "information'"contents.

Items taken from the "Human Relation Area Files" (Murdock 1967) are used for the purposes of cross-cultural surveys and provide standardized data and samples for comparisons by coding components of culture described in narratives and literature (Burton and White 1987). The international classification system of folktales (AaTh: Aarne Thompson, 1961) also leads to classificatory analysis.

Studies of informant accuracy and control of the validity of retrospective data in anthropology (Freeman et al. 1987, Bernard et al. 1985), along with economic models, optimality models from

evolutionary ecology (Keegan 1986, Smith 1991), research on Paleolithic and Neolithic industries (Odell 1988, Winterhalder and Smith 1981), all involve substantial statistical and mathematical treatments.

The classical language dictionaries, the catalogues, and the ever-growing list of data banks are also quantified, and consist of ordered cultural information ready to be processed. We shall assume that this tentative list is sufficient to make the point that information in culture and information in systems thinking have many things in common to allow for useful metaphors and for knowledge yielding classifications, protocols, guide-lines or mathematical elaboration.

It is in moments of interaction that both culture and information, whatever their exact nature, are best appraised. Interaction within specific contexts of productive activities, interpersonal relations and cognitive processes in which several types of information are used and to which both – culture and knowledge contribute. We must therefore, privilege in all Human Use Systems observations of the context and connections that ultimately bring change and provide societies with the ability to switch between different modes of behavior in response to changing environments.

Conclusion

Metaphors are important and, we believe relevant, if they can reframe what is already known, and in the same time reveal new avenues for research. In this sense we have attempted, in this paper, to present a specific area in which systems thinking could account for ongoing anthropological discussions. Human Use Systems, as a systems concept, involve linking together into an emerging (meta)system, a population, it's resource base and a regulator containing culturally constructed information, knowledge and guidelines for action and patterning. All three subparts of the HUS are seen as dynamic systems encompassing elements, items, interactions and processes — that are relevant to Anthropology — in particular places and particular time.

When we explored potential ways on which such HUS may function within the framework of systems dynamics, we considered processes of internalization. That is, ways by which a community may receive, construe and apply information, as well as expand across territories and claim time, either as a historical experience or as an alternative temporality. Interactions between the HUS sub-parts, as well as, learning processes point to open system functioning. The open system made up of the three sub-systems, acquire an emerging system that includes the requirements, controls, values and purposes that result when a society spreads over new territories, exploits new resources and reconstructs history.

Openness materializes in contacts and exchanges. In this context change and adaptive behavior largely depend, today, on global networks and global processes that reach each particular Human Use System. In the same time a human community that functions as an open system needs a "regulator" that can both maintain it's coherence and enable it to switch between different modes of behavior for survival or for upgrading its, culturally determined, common wealth. We contend that a regulator, in social dynamics, that displays such capacities is an important part of what we usually consider to be culture in Anthropology. Furthermore, regulation processes, within the framework of Human Use Systems construct, determine and enforce "information". In this respect, systems analogies for information, should also deal with questions relating to "free lunch elements of knowledge", the circulation of global information, in terms of the consistency principle and the knowledge paradox raised by science philosophers.

These issues seem to call for a degree of mathematization and pose a number of technical questions regarding systems functioning. We do not attempt to answer these here, but offer a means for understanding how and why new Human Use Systems are continuously emerging within the global urban realm.

[1] In another, yet similar, context Marvin Harris (1992: 295) noted: "A branch of the human sciences that ignores these immense events, that interprets them exclusively in terms of relativized 'local knowledge', or that derides the attempts to understand them in terms of nomothetic principles runs the risk of being confined to the backwaters of contemporary intellectual life."

[2] The issues related to land claims by Native Americans in both the US and Canada, as well a similar demands for land and resource quotas by Australian Aborigines and New Zealand Maoris are well known to anthropologists. Also see Donner 1992.

[3] In this context the term system is often used when speaking of political, economic, social and technological systems, we chose to avoid it since it differs from the concept systems thinking uses.

[4] In a similar way one could wish to trace the spread of horses in North America, the adoption of American corn in the Balkan countries and in the Ottoman Empire, the extensive use of modern weaponry by Third World's guerrillas.

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Appendix

A Ponapean view of evolution in the beginnings (Luelen 1977)

The beginning of the story of Ponape in olden times.

In older times a canoe set forth from the shores of a far-off land (p. 7). Once in Ponape the people who came from across the sea worked to make the land and once the work was finished they sailed back to their true land from which they had first come. They then decided that one of them should stay and guard the land so Linuetu and her husband stayed" (*para.10:9*)

"She then became pregnant and bore children. She bore sons and daughters. They multiplied in the land and the land became populous, but they were more ignorant than those who came and started the land for when they had come they had clothes (…) But, after they have stayed there awhile they became naked, for they had nothing with which to make their clothes." (para.11:10). Also "they did not have much food, or good food" (*para. 12*).

When a second voyage brought another canoe, the newcomers "for a long time … used to live under rocks" (*para. 13*). A third voyage brought four men who began to make houses but had nothing to thatch them with (*para. 14*). It is only after the fourth voyage that the ivory nut palm was imported and provided thatch for the houses (*para. 15*).

At that time (*Chap. 3:12*) people became different from each other and formed two kinds, one kind was Arem [humans] the other Liat [cannibals]. Liats "originated from among the women". The belief goes that they were sort of "mutant" young girls that later multiplied in Ponape.

Arems exterminated the cannibals and improved their life, their houses and made cloths from the bark of trees (*Chap. 4:13*) they also developed a number of tools (*para. 3:13*). However problems resulting from the continuous presence of cannibals are narrated in several subsequent chapters.

After that, a fifth voyage is recorded bringing in Meija. It is he who introduced fire and cooking knowledge in Ponape. The sixth voyage brought from "Downwind Katau" two sisters who carried yam, banana shoots and the bright mirror stone of Ilol. Sometime later their brother came looking for them, he also brought another plant (*Chap. 5:14-15*).

At that stage of the narrative the Book of Luelen turns in a comprehensive list of "all kinds of plants" and "things of that time". The list extends from chapter 9 to chapter 18 (*pp. 18-25*). We should note that according to Luelen account, "all names originate from actions and times and work." (*p. 26,* emphasis added.)

The narrative of this period of building continuous till chapter 20 where we are told that, at that time, people became a little more enlightened "for they were not friendly to the cannibals." Yet:

“1. They had few words, […] they did not have any great work. […]

“Their only great work was to look about for things which they […]“ would eat.

“Many of them had no clothes; they would go naked.[…]

“They also did not have [barkcloth] bed sheets […]

“2. The people of this age are better than those of older times.” (p.26)

An open system’s ideal-type.

It is our view that some of the salient traits of an open Human Use System are clearly distinguished when we deconstruct this story. For this it will be sufficient to remark that Ponapean tradition stretches the following points:

• People were always coming from the sea;

• On the island of Ponape, life could be precarious to the point of receding towards nakedeness, famine and loss of knowledge. Even the human stock was imperiled by the appearance of cannibals.

• Improvements came from the gradual layering of incoming people bringing cultivars, artifacts and know-how.

• Incoming knowledge included the foundation of the political organization established by the Lords of Teleur, initiators of the building of the 80-90 artificial islands cluster that formed the town of Nanmatol (Hanlon 1988).

• Cultural gifts and knowledge come from contacts and from newcomers. “Contact” thus appears to be both the normal thing and something with which Ponapeans have to strive for to maintain their identity and even their lives. Yet, they know from past experience that, the insular social order may also move towards situations that are considered dysfunctional and negative, in which case people may have to act against it and overthrough cruel paramount chiefs with, or without external help.

ARCHIVE ISSN 2654-2366 EBE/NLG